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Identifying Perceived Barriers to Exercise Behaviour Change Associated with Transition through the Stages of Change Model.

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ABSTRACT

This study uses the Stages of Change Model (SOC) (Prochaska, DiClemente & Norcross, 1992) to investigate *perceived barriers* that predict adherence to exercise. The aim of this research is to identify the different barriers at the distinct stages of the SOC. In total, 213 participants completed an online questionnaire with three measures: SOC, Perceived Barriers and Perceived Benefits to physical activity. The SOC measure allocated participants into one of the five possible stages. This allowed for the investigation of perceived barriers at the separate stages of the model. At the *preparation* stage of the SOC, the significant barriers were related to 'Motivations' and 'Family/Friend Support'. During the *action* and *maintenance* stages, the factors with significant impact were barriers related to 'Motivations' and 'Self-Consciousness' and gender. Results suggest there are different perceived barriers present at the distinct stages. Motivational barriers were found to impact individuals throughout the model. When individuals are considering an exercise behaviour change during the *preparation* stage, it is important that they receive support from friends and family. In the *action* and *maintenance* stages, individuals' levels of self-confidence could affect their decision to exercise. In these two stages, males are more likely to be impacted than females.

KEY WORDS:	EXERCISE BEHAVIOUR	BARRIERS	STAGES OF CHANGE MODEL		
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INTRODUCTION

Latest figures have shown that physical inactivity is the fourth leading risk factor for global mortality and that globally, 1 in 4 adults is not active enough (WHO, 2018). In the UK, it is a major objective of the government to increase the amount of regular physical activity. The NHS guidelines recommend that adults aged between 19-64 should engage in 150 minutes of moderate aerobic exercise or 75 minutes of vigorous aerobic exercise per week (NHS, 2018).

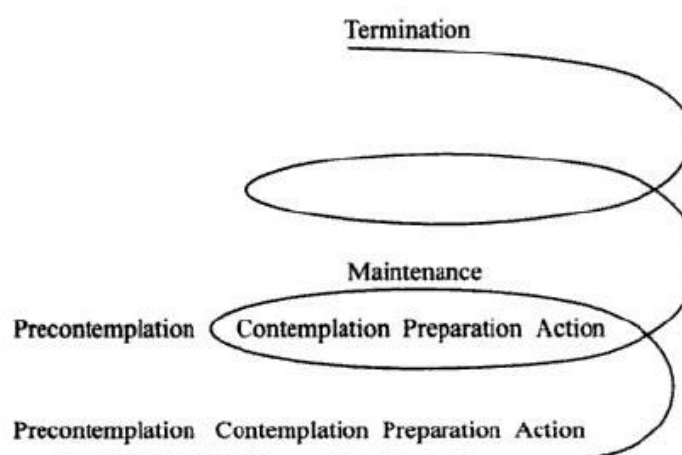
Adherence to exercise programs is a significant concern to health psychologists (Dishman, 1982). The benefits to exercise include a better control of weight management; improving physical, mental and cognitive functioning; and preventing fatal illnesses such as coronary heart disease and some cancers. Regular participation in physical activity establishes an individual's life satisfaction and improves mental well-being by relieving feelings of tension, anxiety and stress (Zayed, Ahmed, Van Niekerk & Ho, 2018). However, even with an informed understanding of the health benefits to exercise, recent statistics have shown that 26% of adults were classified as inactive (NHS, 2017). This low attrition rate suggests there are potential barriers to exercise adherence. It is often reported that there is limited evidence available regarding the barriers to exercise adherence (Jones, Harris, Waller & Coggins, 2005).

It has been argued that for exercise adoption to be investigated, it is important to gain an understanding of the basic structure of exercise adoption and maintenance (Romain, Bernard, Hokayem, Gernigon & Avignon, 2016). In order to do this, using a theoretical model is the best approach. However, McAuley (1993) argued that a criticism of many theoretical approaches is that exercise adoption and maintenance is viewed as a static phenomenon. One framework that explores behaviour change as a continuous experience, is the Transtheoretical Model of Behaviour Change (TTM) (Prochaska, DiClemente & Norcross, 1992).

Prochaska, DiClemente & Norcross (1992) developed this theory to look at health behaviour change as a non-linear progression through specific stages. A construct of this theory is the Stages of Change Model (SOC) which was originally developed for application to health risk behaviours, such as smoking and drug use, but can also be applied to health protective behaviours such as dietary modification and exercise adoption (DiClemente & Velasquez, 2002). As relapse is inevitable with many health behaviours, individuals are highly likely to repeat stages. Hence, the model is conceptualized as a spiral to better explain an individual's attempt at behaviour change (Prochaska, DiClemente & Norcross, 1992). This model involves a progression through five stages: *precontemplation*, *contemplation*, *preparation*, *action* and *maintenance* (see Figure 1). *Precontemplation* is the stage at which the individual has no intention to change their behaviour (Prochaska, DiClemente & Norcross, 1992). They do not see their behaviour as maladaptive, and are unaware of a problem. Prochaska, DiClemente & Norcross (1992) explain that usually the individual is under pressure from family members, friends or employees to change their behaviour. They often feel coerced to transition into the next stage. *Contemplation* is the stage where an individual accepts that there is a problem, but is yet to take action to solve this problem. Within this stage, individuals have not yet made a commitment to change their behaviour. Prochaska, DiClemente & Norcross

(1992) highlight that individuals in this stage are weighing up the pros and cons of the solution to the problem. *Preparation* is the stage in which an individual has not yet found the successful criterion for making a behaviour change. They are aware that they need to change, and intend to make a change in the next month (Prochaska, DiClemente & Norcross, 1992). *Action* is a stage that has been defined as the point at which individuals adapt their behaviour in order to overcome the problem. This is the stage that requires the greatest commitment of the individual's time and energy. DiClemente & Velasquez (2002) argue that if an individual does not have adequate self-efficacy, they are unlikely to achieve a long-term behaviour change. *Maintenance* is the final stage which should be considered as a critically important continuation (DiClemente & Velasquez, 2002). Individuals will transition to this stage if they are successful at maintaining their behaviour for longer than six months. If an individual manages to abstain from relapse, they will remain in this stage for a lifetime (Prochaska, DiClemente & Norcross, 1992).

Figure 1: *The spiral model of the stages of change.*



Research has demonstrated that the SOC specifies *self-efficacy* and *decisional balance* as key predictors of stage transition (Armitage, Sheeran, Conner & Arden, 2004). *Self-efficacy*, a concept explored within Bandura's (1977) social-cognitive theory, refers to the level of confidence an individual has in their ability to perform a behaviour. *Decisional balance* is the individuals' consideration of the benefits and costs to a particular behaviour (Janis & Mann, 1977). These two concepts are often referred to as the *predictors of change* and are integrated into the SOC. Transition through the stages is dependent on the pros and cons of the behaviour (Prochaska et al, 1994) and the level of self-belief an individual has (Courneya, Niggs & Estabrooks, 1998).

However, McAuley (1993) argues that self-efficacy and decisional balance are complex predictors of stage transition. He argues that exercise adherence is a complicated notion and thus there are other factors that either work alone, or in concert with self-efficacy to influence exercise maintenance. McAuley (1993) investigated the role that self-efficacy has in exercise adoption and maintenance on a sample of middle aged adults. Participants took part in a 5-month long exercise program engaging in aerobic exercise three times a week. It was found that self-

efficacy was only successful at predicting exercise adherence up to 3 months and was unable to forecast such behaviour at 5 months. In fact, at the 5-month mark, past behaviour was much more predictive of exercise adherence than self-efficacy. From this result, McAuley (1993) suggested that self-efficacy is more indicative of exercise behaviour at the *action* stage rather than at the *maintenance* stage. McAuley's study has been successful at recognizing the SOC as an effective medium to measure exercise acquisition and maintenance. However, it failed to recognize the possibility of different variables having an impact on behavior at each distinct stage. Therefore, it is at this juncture that it can be suggested there are alternative factors, other than self-efficacy and decisional balance, that act as barriers to exercise adherence.

Clarke & Eves (1997) explored the application of the key constructs of the SOC with a particular focus on self-efficacy and decisional balance. Participants in this study had all been prescribed to a three-month exercise program (due to a health problem) by a health professional. All participants also had to complete the decisional-balance scale, self-efficacy scale and a sport & exercise barriers questionnaire (CSEBQ). Clarke & Eves (1997) found no significant difference for self-efficacy across the stages, and consequently suggested that self-efficacy is not fundamental to behaviour adoption and maintenance. In contrast, decisional balance measures did have an impact in the modification of behaviour which suggests that it should be considered as a critical component of the SOC. They also found four main barriers to exercise adherence: 'lack of time', 'lack of support', 'dislike of exercise' and 'lack of facilities'. In relation to the stages of change, the 'dislike of exercise' barrier was most prominent at the *precontemplation* stage, decreasing by the *preparation* stage. The 'lack of adequate facilities' increased alongside each progressive stage. These findings suggest that there are in fact other determining factors, such as barriers, that affect exercise behaviour modification and adherence.

On the back of these findings, more recent research has continued to explore the relevance of self-efficacy for the SOC (Prochaska, DiClemente & Norcross, 1992). Jones, Harris, Waller & Coggins (2005) argued that although a lot of research into exercise adoption and maintenance has found self-efficacy as a predicting factor; some of the research has produced inconsistent findings. Their study of a 24 session exercise participation scheme aimed to answer the specific research question of whether self-efficacy is associated with exercise participation and adherence. In addition, participants were assessed for their present level of activity, their position in the stages of change, their exercise self-efficacy and their expectations and achievements of change. It was found that when looking at self-efficacy and Stages of Change, there was no significant difference between individuals' level of self-efficacy in the *pre-contemplation* stage, *contemplation* stage or the *preparation* stage. The absence of discrepancy that self-efficacy has across the stages is consistent with the findings of Clarke and Eves (1997). This suggests that the self-efficacy estimates for exercise behaviour adoption in relation to the SOC can, sometimes, be unreliable.

Following on from the findings of Clarke & Eves (1997), it can be suggested that there are other factors, besides self-efficacy and decisional balance, that play a role in the success of the adoption and maintenance of exercise behaviour. Gerend, Shepherd & Shepherd (2013) argue that all health behaviours have social,

psychological, economic, environmental and logistical factors that, if not overcome, can hinder exercise adoption and maintenance. Support for this perspective comes from Armitage, Sheeran, Conner, & Arden (2004) who argue that very little other research has examined the factors that affect stage transition of the SOC. They suggest that the focus on decisional balance and self-efficacy as the only predictors of change has restricted the scope to explore alternative variables. This is further supported by Lowther, Mutrie, & Scott (2007) who argue that during the *action* and *maintenance* stages, decisional balance and self-efficacy are not as prominent predictors.

Some research has been conducted to explore the potential variables that limit exercise behaviour. Brown (2005) popularized the term *perceived barriers* which refers to the evaluation of the potential obstacles that could prevent an individual from engaging in a health behaviour, such as physical activity. *Perceived benefits* represent the evaluation of the potential advantages of a particular health behaviour such as increased physical fitness. Brown (2005) investigated the impact that perceived benefits and perceived barriers have on the level of physical activity. Participants had to respond to two questionnaires. The first being a measure of perceived benefits and perceived barriers using the Exercise Benefits and Barriers Scales (EBBS) (Sechrist, Walker & Pender, 1987). The second being a Physical Exercise Self-Efficacy Scale (PESES). Lastly, participants were measured for their current level of physical activity. The results of the study only produced a significant correlation for the perceived benefits; there was no significant finding for the impact of perceived barriers on physical activity. It could be argued that the reason for these findings is that the EBBS scale is now quite dated and consequently the list of barriers is no longer relevant. Furthermore, the scale includes just fourteen questions related to perceived barriers. It could be argued that this limited set of barrier items restricts the inclusion of all of the potential factors that affect exercise attrition. By increasing the number of barrier items, it could be possible that a much richer, and potentially more significant set of findings could be produced.

As can be seen from this review, most empirical research has failed to envision perceived barriers of physical activity as a complex and multifaceted concept (Gerend, Shepherd, & Shepherd, 2013). For example, as pointed out by the SOC (Prochaska, DiClemente & Norcross, 1992), behaviour change is a continuous development through distinct stages. Therefore, it could be argued that there are different perceived barriers that are differentially pertinent at the separate stages. It is unlikely that a perceived barrier which is limiting an individual's progression from the *contemplation* to *preparation* stage would still affect them during the *maintenance* stage.

Thus, the present study aims to use the SOC to investigate the perceived barriers to exercise adoption and adherence. By using the SOC, this study will be able to view this health behaviour as a process, and therefore be able to identify the variety of barriers that are undoubtedly present during the distinct, complex stages of behaviour change. This study has a particular focus on the perceived barriers which are prevalent at the *preparation*, *action* and *maintenance* stages. This is due to previous research suggesting there are currently not any appropriate constructs that are accurate predictors of behaviour at these stages (McAuley, 1993; Lowther, Mutrie, & Scott, 2007). An additional reason for focusing on perceived barriers is that

the barriers that prevent individuals from initially performing the behaviour will be different once they are attempting to sustain the behaviour (Gerund, Shepherd & Shepherd, 2013). The aim of this research is to identify the impact of perceived barriers to exercise behaviour at different stages of behaviour change, through questionnaire methodology with the expectation that results would show different perceived barriers will be prevalent at the separate stages of the model.

METHOD

Participants

In total, 213 participants completed the online questionnaire, 165 (77.5%) were female and 48 (22.5%) were male. The participants' ages ranged from 18-65+ years: 29.1% were aged 18-25; 13.1% were aged 26-35; 24.9% were aged 36-45; 29.1% were aged 46-55; 3.3% were aged 56-65; and .5% were over the age of 65.

The study was approved by the Oxford Brookes University Psychology Research Ethics Committee. The participants could not access the online questionnaire until informed consent was obtained. It was made aware to the participants they didn't have to answer any question they didn't want to and that they could withdrawal from the survey at any time.

Participants were an opportunity based sample and were recruited through social media platforms, such as Facebook. In addition, opportunity sampling was used to target individuals known to the researcher.

Materials

The questionnaire was created on the online software, Qualtrics. Before participants could access the questionnaire they had to read through an online information sheet. Participants could not access the questionnaire until they had ticked a box to give consent to participation. The questionnaire had three measures: Stages of Change, Perceived Barriers and Perceived Benefits.

The purpose of the first subsection of the questionnaire was to ascertain where an individual currently resides in the SOC. The statements were taken from Lamb & Sissons-Joshi (1996) who created the stage instrument based on Prochaska, DiClemente & Norcross' (1992) depiction of the five stages from *precontemplation* to *maintenance*. Their intention was to determine the attitude of the individual in each of the five stages, by constructing sentences that were representative of the mindset at each stage. The statements were then adapted to fit the present study, as Lamb & Sissons-Joshi (1996) were investigating dietary habits.

Six statements related to the level of physical activity they currently participate in were presented and participants were asked to select one statement to best represent their current position of physical activity. This selection formed their allocation in the SOC model. The statements correspond to the respective stages. The first statement was a baseline measure: *'I haven't given the matter of regular physical activity any thought at all'*. Participants who selected this statement did not currently hold any position in the SOC. Next, the *pre-contemplation* stage: *'I think*

about regular physical activity from time to time, and then put the matter out of my mind'. Then, the *contemplation* stage: *'I keep meaning to do something to increase my level of physical activity, but don't actually get around to it'*. The fourth statement related to the *preparation* stage: *'From time to time I partake in regular physical activity, but at other times I rarely exercise'*. The *action* statement demonstrated a frequency in the behaviour: *'I have been regularly maintaining physical activity in my day-to-day life for the last 6 months'*. And lastly, the *maintenance* stage: *'I have been regularly maintaining physical activity in my day-to-day life for longer than the last 6 months'*.

Before the final questionnaire was created, an informal pilot study was conducted to gain an understanding of the perceived barriers to exercise. In total, 15 people were asked for their perception of the barriers that prevent exercise adherence. The results from this pilot study have been used to frame the questions on perceived barriers.

The measure of perceived barriers to physical activity had 32 statements. This questionnaire was created for the purpose of this study and the questions were based upon the results of the pilot study. The perceived barriers subscale consisted of 32 items. The questions explored the variety of perceived barriers that individuals could experience when considering or performing exercise behaviour. For example *'I would work out in the gym, but I don't like that there are mirrors everywhere'*. Response to this set of questions was on a 7 point Likert Scale ranging from 'strongly agree, agree, somewhat agree, neither agree nor disagree, somewhat disagree, disagree, strongly disagree'. It is important to note that all of the scales used gave the participants the option to answer at a mid-point, for example, 'neither agree nor disagree'. By allowing the participant to offer an unbiased response if the question doesn't relate to them, it reduces the chance of false data.

Perceived Benefits to physical activity was assessed via 10 basic statements related to the general health benefits of regular exercise. This scale was created for the purpose of this study. The scale had a high level of internal consistency, as determined by a Cronbach's alpha of 0.846. The questions were based upon the typical advantages to regular exercise such as weight loss, weight control, strengthening of bones and muscles and improving resting heart rate and blood pressure. For example, *'I understand the health benefits of exercising such as weight loss and improved cardiovascular fitness'*. Again participants were able to answer on a 7 point Likert scale ranging from 'strongly agree' to 'strongly disagree'.

Design

This study used a within-subjects design meaning that all of the participants answered the entire set of questions for both of the independent variables.

There were two independent variables: Perceived Barriers to exercise behaviour and Perceived Benefits to exercise behaviour. The dependent variable was the allocation of the individual in the Stages of Change model: this model had 6 levels: 0 = No placing on the Stages of Change Model, 1 = *Pre-Contemplation* Stage, 2 =

Contemplation Stage, 3 = *Preparation* Stage, 4 = *Action* Stage, 5 = *Maintenance* Stage.

Procedure

As previously mentioned, this was an online questionnaire with three separate measures: Stages of Change, Perceived Barriers and Perceived Benefits. The questionnaire had an invariant order.

RESULTS

Stages of Change

Participants were asked to allocate themselves to a stage by selecting one of six possible statements. Table 1 shows the number of respondents who chose each of the six statements. No participants selected the statement 'I haven't given the matter of regular physical activity any thought at all'. Over 50%, 113 of the total 213 participants, allocated themselves into Stage 5 (*maintenance*), making it the most prominent stage.

Table 1. *Allocation of respondents according to stages of change*

Stage and wording of items	Number of respondents	Percentage of respondents (%)
0 I haven't given the matter of regular physical activity any thought at all	0	0
1 I think about regular physical activity from time to time, and then put the matter out of my mind	1	.5
2 I keep meaning to do something to increase my level of physical activity, but don't actually get around to it	17	8
3 From time to time, I partake in regular physical activity, but at other times I rarely exercise	60	28.2
4 I have regularly been maintaining physical activity in my day-to-day life for the last 6 months	22	10.3
5 I have been regularly maintaining physical activity in my day-to-day life for longer than the last 6 months	113	53.1
Total	213	

Perceived Benefits to Physical Activity

As previously mentioned, the questions in this subscale asked participants to state the extent to which they agree on the general health benefits to regular physical activity. For example, '*I understand the health benefits of exercising such as weight loss and improved cardiovascular fitness*'. As these are universal health benefits of exercise, the distribution of participant responses fell mostly in the 'Strongly Agree' or 'Agree' category. Therefore, due to the nature of the questions there was little or no distribution in responses. This poor distribution meant that the scale was not analysed.

Perceived Barriers to Physical Activity

The means and standard deviations for each of the 32 items of the perceived barrier subscale were calculated. Results can be seen in Table 2.

Table 2. Means and standard deviations of perceived barrier subscale

	Mean	SD
I often feel too tired to exercise	4.51	1.56
If I am tired, I find it difficult to motivate myself to exercise	5.27	1.49
I prefer to exercise with friends	4.56	1.80
If a friend cancelled on me, I wouldn't go alone	2.94	1.60
I like to exercise alone	4.64	1.54
My spouse/significant other encourages me to exercise	4.56	1.54
My family encourages me to exercise	4.59	1.56
My friends encourage me to exercise	4.64	1.43
I often feel like I run out of time to exercise	4.93	1.69
I always fit in time to exercise	4.01	1.73
There are no easily accessible work out spaces near me	2.23	1.35
The gym is always too busy when I go	3.29	1.42
I find it difficult to motivate myself to exercise	4.02	1.76
I don't like to work out in a busy gym/workout space where people will be watching me	4.26	1.84
I would work out in the gym, but I don't like that there are mirrors everywhere	3.28	1.70
I enjoy physical activity, but I don't have the confidence to work out	2.64	1.54
I consider exercise a task	4.02	1.76

I don't prioritise exercise as I don't enjoy it	3.06	1.70
If I am stressed, I won't exercise	3.18	1.81
I often don't have the time to exercise due to work responsibilities	4.28	1.79
I often don't have the time to exercise due to family responsibilities	4.01	1.86
Occasionally I use family/work responsibilities as an excuse not to engage in physical activity	3.98	1.82
I don't exercise in the fear that I will injure myself	2.05	1.27
I have injured myself in the past through exercise and don't work out now in the fear that I will injure myself again	2.12	1.32
I don't have the skill to work out alone	2.37	1.47
I prefer to work out during an exercise class led by an instructor	4.39	1.95
If my usual exercise class is full, I won't work out alone	3.17	1.67
I don't like to work out alone without an instructor or personal trainer as I don't know how to	2.75	1.62
If the weather is cold and wet, I struggle to find the motivation to work out	4.18	1.87
If the weather is too hot, I struggle to find the motivation to work out	3.77	1.83
I don't think I would be able to maintain a regular exercise routine	2.79	1.66
I don't believe in myself enough to engage in regular physical activity	2.55	1.62

Due to the large number of items in this subscale, a factor analysis was conducted to reduce the data and identify the latent variables underlying response to the perceived barrier items.

Factor Analysis

A Factor Analysis was performed on the 32 items related to the perceived barriers to physical activity. From an examination of the scree plot and eigenvalues, it was indicative that a six factor solution was appropriate, which explained 62.86% of the variance. Finally, a varimax rotation was applied to the components. Table 3 shows the items that were most highly loaded onto each of the six components.

Factor 1: Motivations. This factor clearly concerned 'Motivations'. Thirteen items load onto it and it is clear from Table 3 that these items are all negative admissions and suggestive of being related to participants' feelings of being unmotivated. These related to feelings of tiredness; using factors such as family responsibilities as an excuse not to exercise; not prioritizing exercise; and feeling too tired to exercise.

Factor 2: Self-Consciousness. This factor clearly concerned feelings of ‘Self-Consciousness’. Six items load onto it and it is clear from Table 3 that these items are all related to participants’ feeling embarrassed and anxious about the gym. For example, the presence of mirrors in the gym; feeling uncomfortable working out in front of other people; and not having the confidence in themselves to work out.

Factor 3: Social. This factor clearly concerned the importance of a ‘Social’ presence. Five items load onto it and it is clear from Table 3 that these items are all related to the impact that the presence of a friend or an instructor can have on the likelihood of exercise behaviour. For example, preferring to exercise with friends.

Factor 4: Time. This factor clearly concerned the influence of ‘Time’. Three items load onto it and it is clear from Table 3 that these items are all related to the impact that time has on exercise behaviour. Participants reported feeling that they often run out of time to exercise, or struggle to make time due to other responsibilities such as family or work.

Factor 5: Injuries. This factor clearly concerned ‘Injuries’. Two items load onto it and it is clear from Table 3 that these items are participants’ admissions to being in fear of injuring themselves whilst exercising. These items were related to individuals confessing that they do not exercise because of this fear, or a past injury impacting whether they exercise because of the fear that it will happen again.

Factor 6: Family/Friend Support. This factor clearly concerned ‘Family/Friend Support’. Three items load onto it and it is clear from Table 3 that these items relate to the importance of support from family and friends. For example, participants admitting that they receive encouragement from their friends, family and significant others to engage in exercise behaviour.

Table 3. *Factor loadings for six factors based on the ‘perceived barriers to physical activity’ items.*

Factor	Item	Loading
1	I find it difficult to motivate myself to exercise	.836
	I don’t prioritise exercise as I don’t enjoy it	.753
	I consider exercise a task	.743
	I don’t think I would be able to maintain a regular exercise routine	.726
	If the weather is cold and wet, I struggle to find the motivation to work out	.723
	If I am stressed, I won’t exercise	.713
	If I am tired, I find it difficult to motivate myself to exercise	.693
	I always fit in time to exercise	.686

	If the weather is too hot, I struggle to find the motivation to work out	.663
	I often feel too tired to exercise	.658
	I don't believe in myself enough to engage in regular physical activity	.592
	Occasionally I use family/work responsibilities as an excuse to not engage in physical activity	.568
	I don't like to work out alone without an instructor or personal trainer as I don't know how to	.430
2	I would work out in the gym, but I don't like that there are mirrors everywhere	.728
	The gym is always too busy when I go	.707
	I enjoy physical activity, but I don't have the confidence to work out	.656
	I don't like to work out in a busy gym/workout space where people will be watching me	.633
	There are no easily accessible work out spaces near me	.563
	I don't have the skill to work out alone	.515
3	I prefer to exercise with friends	.850
	I like to exercise alone	-.826
	If a friend cancelled on me to exercise, I wouldn't go alone	.578
	I prefer to work out during an exercise class led by an instructor	.540
	If my usual exercise class is full, I won't work out alone	.512
4	I often don't have the time to exercise due to family responsibilities	.732
	I often feel like I run out of time to exercise	.698
	I often don't have the time to exercise due to work responsibilities	.679
5	I have injured myself in the past through exercise and don't work out now in the fear that I will injure myself again	.890
	I don't exercise in the fear that I will injure myself	.886
6	My family encourages me to exercise	.828
	My spouse/significant other encourages me to exercise	.700
	My friends encourage me to exercise	.693

Binomial Logistic Regression

The hypothesis for this study was to investigate the perceived barriers that were most pertinent at the separate stages of the SOC. However, as can be seen in Table 1, the distribution of participants across the five stages was considerably uneven. Participants' allocation was greatest in just two stages: *preparation* (28.2%) and *maintenance* (53.1%). Due to this uneven distribution, it was not possible to investigate the barriers at each stage separately as was originally intended.

Therefore, in order to still explore the effect of perceived barriers, a binomial logistic regression was used. The analysis' that follow use a dependent variable which contrasts being at one stage to its antecedent stages (as can be seen in Table 4). In other words, investigating the impact of perceived barriers, gender and age (independent variables) that predict having reached a stage or having not yet reached that stage. As can be seen in Table 4, for each dependent variable the 'X' demonstrates the prominent stage for each analysis, and the 'x' indicates the comparison antecedent stages included in the dependent variable.

Table 4. The dependent variables of the binomial logistic regression predicting how perceived barriers contribute to stage identity.

	Pre- Contemplation	Contemplation	Preparation	Action	Maintenance
Preparation	x	x	X		
Preparation and Action	x	x	X	X	
Action and Maintenance	x	x	x	X	X
Maintenance	x	x	x	x	X

As can be seen in Table 4, the first analysis uses a dependent variable 'Preparation' which is the preparation stage vs all of the preceding stages (i.e. *pre-contemplation* and *contemplation*). This is a subset of the data excluding all participants in the *action* and *maintenance* stages. The reason for this is that it does not make sense to include participants who are in *maintenance* and *pre-contemplation* as a contrast to *preparation*. The independent variables were perceived barriers, age and gender.

The logistic regression model was statistically significant, $\chi^2(8) = 19.383$, $p < .05$. The model explained 33.3% (Nagelkerke R^2) of the variance and correctly classified 80.8% of cases. Sensitivity was 93.3%, specificity was 38.9%, positive predictive value was 83.5% and negative predictive value was 63.6%. Of the eight predictor variables, two were statistically significant: 'Motivations' and 'Family/Friend Support' (as can be seen in Table 5). Perceived barriers related to 'Motivations' (.006) and 'Family/Friend Support' (.011) made a significant contribution to predictions in the *preparation* stage. This means that individuals in the *preparation* stage (or the preceding stages) are more likely to be affected by barriers related to 'Motivations' and 'Family/Friend Support'.

Table 5. Logistic regression predicting likelihood of exercise behaviour at the *preparation* stage (vs. having not yet reached that stage) based on perceived barriers, gender and age.

	B	S.E.	Wald	df	p	Odds Ratio
Motivations	-1.55	.57	7.46	1	.006	.21
Self-Consciousness	-.34	.30	1.32	1	.250	.71
Social	-.08	.32	.06	1	.813	.93
Time	-.08	.43	.03	1	.856	.92
Injuries	-.29	.24	1.42	1	.234	.75
Family/Friend Support	.97	.38	6.49	1	.011	2.65
Gender (1)	-.26	1.01	.07	1	.799	.77
Age	.25	.28	.85	1	.358	1.29
Constant	2.71	1.22	4.92	1	.027	15.04

Note: Gender is for males compared to females.

This next analysis uses a variable contrasting being at the *action* and *preparation* stages compared to all previous stages (*pre-contemplation* and *contemplation*). This is a subset of the data excluding all participants at the *maintenance* stage. A binomial logistic regression was performed with *action* and *preparation* vs. all other stages as the dependent variable and the perceived barrier factors, age and gender as the independent variables.

The logistic regression model was statistically significant, $\chi^2(8) = 23.178$, $p < .05$. The model explained 35.8% (Nagelkerke R^2) of the variance and correctly classified 86.6% of cases. Sensitivity was 59.1%, specificity was 96.7%, positive predictive value was 86.6% and negative predictive value was 86.6%. Of the eight predictor variables, only one was statistically significant (as can be seen in Table 6). Perceived barriers related to 'Motivations' (.001) made a significant contribution to predictions in the *action* and *preparation* stages. Individuals in these stages are more likely to be affected by perceived barriers related to 'Motivations'.

Table 6. Logistic regression predicting likelihood of exercise behaviour at the preparation and action stages (vs. not having yet reached these stages) based on perceived barriers, gender and age.

	B	S.E.	Wald	df	p	Odds Ratio
Motivations	-2.25	.67	11.25	1	.001	.11
Self-Consciousness	-.07	.31	.06	1	.811	.93
Social	-.28	.33	.71	1	.400	.76
Time	-.53	.36	2.22	1	.137	.59
Injuries	-.22	.26	.73	1	.393	.80
Family/Friend Support	.68	.37	3.34	1	.068	1.96
Gender (1)	-.16	.74	.05	1	.830	.85
Age	-.23	.23	1.01	1	.314	.79
Constant	.63	.95	.44	1	.508	1.88

Note: Gender is for males compared to females.

The analysis that follows uses a variable contrasting being at the *action* and *maintenance* stages with all previous stages. This binomial logistic regression investigated which perceived barriers predict being at the *action* and *maintenance* stages vs. not having yet reached these stages (as can be seen in Table 4). A binomial logistic regression was conducted with perceived barriers, age and gender as the independent variables.

The logistic regression model was statistically significant, $\chi^2(8) = 36.852$, $p < .05$. The model explained 40.6% (Nagelkerke R^2) of the variance and correctly classified 85.2% of cases. Sensitivity was 94.7%, specificity was 36.4%, positive predictive value was 88.4% and negative predictive value was 57.1%. Of the eight predictor variables, three were statistically significant: 'Motivations', 'Self-Consciousness' and gender (as seen in Table 7). Barriers related to 'Motivations' (.000) and 'Self-Consciousness' (.002) made a significant contribution to predictions in the *maintenance* and *action* stages. Perceived barriers related to 'Motivations' and 'Self-Consciousness' are more likely to affect individuals at these stages. Males were 7.17 times more likely to be affected by perceived barriers in the *action* and *maintenance* stages than females.

Table 7. Logistic regression predicting likelihood of exercise behaviour at the maintenance and action stages (vs. not having yet reached these stages) based on perceived barriers, gender and age.

	B	S.E.	Wald	df	p	Odds Ratio
Motivations	-2.12	.52	16.92	1	.000	.12
Self-Consciousness	-1.09	.35	10.04	1	.002	.34
Social	-.43	.35	1.47	1	.226	.65
Time	-.11	.31	.13	1	.724	.90
Injuries	.00	.37	.00	1	.991	1.00
Family/Friend Support	-.47	.33	2.04	1	.154	.62
Gender (1)	1.97	.85	5.32	1	.021	7.17
Age	.15	.24	.40	1	.527	1.17
Constant	-.52	.95	.30	1	.586	.60

Note: Gender is for males compared to females.

The analysis that follows investigates what predicts being at the *maintenance* stage as opposed to all other stages (*pre-contemplation*, *contemplation*, *preparation* and *action*). A binomial logistic regression was performed with *maintenance* vs all other stages as the dependent variable and the perceived barrier factors, age and gender as the independent variables.

The logistic regression model was statistically significant, $\chi^2(8) = 141.664$, $p < .05$. The model explained 64.9% (Nagelkerke R^2) of the variance and correctly classified 83.6% of cases. Sensitivity was 85%, specificity was 82%, positive predictive value was 84.2% and negative predictive value was 82.8%. Of the eight predictor variables, three were statistically significant: 'Motivations', 'Self-Consciousness' and gender (as seen in Table 8). Perceived barriers related to 'Motivations' (.000) and 'Self-Consciousness' (.000) made a significant contribution to predictions in the *maintenance* stage. These significant values suggest that individuals at this stage are more likely to be affected by perceived barriers related to 'Motivations' and 'Self-Consciousness'. Males were 3.08 times more likely to be affected by perceived barriers in the *maintenance* stage than females.

Table 8. Logistic regression predicting likelihood of exercise behaviour at the maintenance stage (vs. not having yet reached this stage) based on perceived barriers, gender and age.

	B	S.E.	Wald	df	p	Odds Ratio
Motivations	- 2.77	.39	49.84	1	.000	.06
Self-Consciousness	-.86	.22	14.88	1	.000	.42
Social	-.37	.23	2.57	1	.109	.69
Time	-.40	.23	3.08	1	.079	.67
Injuries	-.18	.20	.83	1	.361	.83
Family/Friend Support	.15	.22	.48	1	.491	1.16
Gender (1)	1.13	.56	4.05	1	.044	3.08
Age	.02	.16	.01	1	.905	1.02
Constant	-.70	.66	1.11	1	.293	.50

Note: Gender is for males compared to females.

As can be seen from this set of regressions, there are different perceived barriers which are pertinent at different stages as one progresses through the SOC model. Firstly, individuals who are currently positioned in the *preparation* stage, or are yet to reach it, are more likely to be affected by perceived barriers related to 'Motivations' and 'Family/Friend Support'. During the *action* and *maintenance* stages, individuals are most likely to be affected by perceived barriers related to 'Motivations' and 'Self-Consciousness'. In these final two stages, males are more likely to be affected by perceived barriers than females.

DISCUSSION

The aim of the present study was to investigate the impact of perceived barriers to exercise adherence. It was hypothesised that different perceived barriers to exercise behaviour were prominent at the separate stages of the Stages of Change (SOC) model. The results fit with the original hypothesis.

The perceived barrier item labelled 'Motivations' appeared as a significant barrier to exercise behaviour at each stage of the SOC. This barrier is related to respondents reporting that they find it difficult to motivate themselves to engage in exercise behaviour. This can be broken down into factors such as stress and tiredness affecting their motivation to maintain a regular exercise routine. Furthermore, this barrier item also includes aspects of self-efficacy with one of the variables reporting '*I don't believe in myself enough to engage in regular physical activity*'. This result mirrors previous research that has suggested that self-efficacy is a key predictor of exercise behaviour and consequently stage transition (Armitage, Sheeran, Conner & Arden, 2004). However, this item is not solely based on self-efficacy which supports the argument that self-efficacy is not the only predictor of exercise behaviour (Clarke & Eves, 1997). This result suggests that at each stage of the SOC it is likely that individuals will experience motivational barriers to exercise behaviour which could be in the form of feelings of tiredness and stress; self-efficacy; not prioritising exercise; or their amount of motivation affecting a regular exercise routine.

As well as the effect of perceived barriers related to 'Motivations', the results also indicated the impact that the perceived barrier 'Family/Friend Support' can have at the *preparation* stage. This perceived barrier item relates to the level of encouragement and support to regularly exercise an individual receives from their friends, family or significant other. This barrier has only showed a significant impact at this stage, which suggests that during the *preparation* stage when individuals are seriously considering a change in their behaviour the support they receive is crucial.

At the *action* and *maintenance* stages of the model, the perceived barriers with a significant result were 'Motivations' and 'Self-Consciousness'. Individuals who have been maintaining exercise for less than six months (i.e. *action*) will continue to experience an impact from the same barriers as they sustain regular exercise for longer than six months (i.e. *maintenance*). Individuals in these stages are more likely to struggle with perceived barriers related to 'Motivations' and 'Self-Consciousness'. For example, their feelings of tiredness and stress affecting their level of motivation. In addition, perceived barriers related to 'Self-Consciousness' which could be in the form of feeling embarrassed about engaging in exercise in front of other people or the presence of mirrors in the gym affecting their self-confidence. The results also showed that males are more likely to be affected by perceived barriers than females in the *action* and *maintenance* stages.

Taken together, the analysis of the data suggests that the most important barriers to physical exercise were 'Motivations', 'Self-Consciousness' and 'Family/Friend Support'. These results coincide with the findings of Clarke & Eves (1997) who reported 'lack of support' and 'dislike of exercise' as main barriers to exercise adherence. Clarke & Eves (1997) also reported 'lack of time' as a main barrier to

exercise adherence. This result contrasts with the findings of the present study, as the perceived barrier factor labelled 'Time' along with 'Social' and 'Injuries' showed no significant impact at any of the stages. The age of the individual also showed no impact on the likelihood of exercise behaviour. These variables are therefore less important in the prediction of exercise behaviour in relation to the SOC.

The current study has been successful at conceptualizing exercise behaviour change as a process and identifying the prominent perceived barriers at the separate stages of the SOC. These findings support the argument that different perceived barriers are pertinent at different times and should be explored as a complex notion (Gerund, Shepherd & Shepherd, 2013). The use of the SOC allowed for the perceived barriers to be explored in such a way. The staging questionnaire created by Lamb & Sissons-Joshi (1996) was successful in categorizing respondents into the stages. This allowed for the different perceived barriers at separate stages to be identified.

Furthermore, this study has recognised that there are other factors besides self-efficacy and decisional balance that predict stage transition for exercise behaviour. The results have highlighted the impact of three perceived barriers that are likely to inhibit individuals' participation in physical activity. Simultaneously, this study does provide support for the self-efficacy argument (Bandura, 1977). The most common perceived barrier was 'Motivations' which does include aspects of exercise self-efficacy, such as '*I don't believe in myself enough to engage in regular physical activity*'. This perceived barrier had a significant impact in each analysed stage, which suggests that self-efficacy is still a determining predictor of stage transition.

The first implication to this study is the relatively small sample size; this creates an issue with applying the results to the general population. In addition to this, the sample is heavily female populated which does not give an accurate representation of the male population. Future research with a greater number of participants could increase the number of males in the sample, which would give a more even distribution and consequently more insight into how perceived barriers affect males and females differently. This would also provide a more accurate representation of the general population.

Following on from this, the uneven distribution of respondents' allocation in the SOC meant that it was not possible to explore the perceived barriers which are present at the *pre-contemplation* and *contemplation* stages. Future research could attempt to recruit a larger number of participants which could solve this issue. This would allow for each stage of the SOC model to be analysed independently which would produce more specific results for the *pre-contemplation* and *contemplation* stages.

The results of this study provide an awareness of the perceived barriers that could affect individuals at separate stages of exercise behaviour change. This understanding allows for stage matched interventions to be created. Generally, for progress through all of the stages, perceived barriers related to 'Motivations' appear to be particularly important. Interventions should focus on ways to motivate the individual to exercise. However, these stage matched interventions could also target the stages separately. Firstly, at the *preparation* stage, interventions can focus on dealing with the perceived barriers related to 'Family/Friend Support'. They can

highlight to friends and family that the support the individual receives is pivotal to their success in exercise behaviour change. Moving into the *action* and *maintenance* stages, the interventions could focus on dealing with perceived barriers related to 'Self-Consciousness'. For example, by attempting to instill a sense of confidence in the individual or highlighting how the benefits to exercise are incomparable to these feelings of anxiety. Furthermore, the interventions for the final two stages of the SOC should be designed to target males. This is due to the results suggesting that males are more likely to be impacted by perceived barriers than females. Future research could develop these stage-matched interventions and investigate their effectiveness in limiting the impact of perceived barriers during the SOC.

This present study has investigated a relatively new area of research in relation to the SOC. There has been a number of arguments proposed for the key predictors of stage transition such as self-efficacy (Bandura, 1977) and decisional balance (Janis & Mann, 1977). However, there has not been a considerable amount of research to explore the effect that perceived barriers have in relation to SOC progression. Future research could use the findings from this study, and those of Clarke & Eves (1997) who identified four main barriers to exercise, to further investigate the impact that perceived barriers to exercise can have to stage identity and stage progression in the SOC. Furthermore, this study has only focused on one specific aspect to the SOC. It is a complex construct and therefore likely that there could be alternative determining factors that impact individuals' stage identity.

In conclusion, this study supports the notion that there are perceived barriers that have an impact on exercise behaviour change. As well as identifying that there are different barriers that can influence the likelihood of exercise behaviour at the distinct stages of the SOC. The results provide effective information to create stage interventions to try to combat these perceived barriers and encourage exercise adherence.

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